

## Early Experiences Elevate Everything: How the Early Years Influence the Life Course Plenary

Dipesh Navsaria: Thank you for that lovely introduction. I'll start off by answering the question that most people have when they read my bio and see the string of letters after my name. Yes, I have a lot of student-loan debt, so we'll just get that out of the way there.

So, again, I'm really pleased to be here to talk about this topic that I think is really so important and I think has such far-ranging implications for the health of children, for their families, and really for our society at large. Of course, in the medical world, we always have disclosure slides. I have no relevant financial relationships to disclose, no off-label or investigational use in my presentation, obviously. Although, I do have one warning that bad things can happen if you hang around and listen to me for too long.

So, these are my two children, and if they listen to me go on for too long, then their faces turn like this. So, I warned them I would use this in some sort of presentation, and they didn't believe me. So, when I tell people that one of my jobs is to work with families and to ask them to do things together with their children that make a difference to their brain development, to their early learning and so on, like reading books together, like talking, like singing, playing -- all these sorts of things --

This is the answer I usually get -- the response. It's "Oh, that's so nice that you do that. That's lovely." And I say, "Yes, it is lovely. I'm glad that I have a job that allows me to do this sort of thing." But I want to move beyond this idea that it's lovely and nice and all that to really recognize that it's critical when we have children receiving this sort of input, these sorts of interactions over time. And that's what I want to try to make the case for today. So, on our short voyage together today, we're gonna talk a bit about a few things. We're gonna talk about the science of early brain development, and I promise this won't be highly technical, but really give you enough information so that you can understand how to apply it.

We'll talk about the result of when things don't go so well. We'll talk about various possibilities for solutions. And then we'll wrap it all up together with things. However, as you heard, I also have training as a children's librarian, so you can't have me show up and give a talk without also having some story time. So, we're going to read a book together. This is by an author named Peter H. Reynolds. It's called "The Dot." And I have the images on the screen that'll be appearing for you as I read it out loud to you.

"Art class was over, but Vashti sat glued to her chair. Her paper was empty. Vashti's teacher leaned over the blank paper. "Ah, a polar bear in a snowstorm," she said.

"Very funny," said Vashti, "I just can't draw."

Her teacher smiled. "Just make a mark and see where it takes you."

Vashti grabbed a marker and gave the paper a good, strong jab. "There."

Her teacher picked up the paper and studied it carefully. 'Hmm.' She pushed the paper toward Vashti and quietly said, "Now, sign it."

Vashti thought for a moment. "Well, maybe I can't draw, but I can sign my name."

The next week, when Vashti walked into art class, she was surprised to see what was hanging above her teacher's desk. It was the little dot she had drawn.

Her dot, all framed in swirly gold. "Hmm, I can make a better dot than that." She opened her never-before-used set of water colors and set to work. Vashti painted and painted. A red dot, a purple dot, a yellow dot, a blue dot, the blue mixed with the yellow.

She discovered she could make a green dot. Vashti kept experimenting. Lots of little dots in many colors. "If I can make little dots, I can make big dots, too." Vashti splashed her colors with a bigger brush on bigger paper to make bigger dots. Vashti even made a dot by not painting a dot. At the school art show a few weeks later, Vashti's many dots made quite a splash.

Vashti noticed a little boy gazing up at her. "You're a really great artist. I wish I could draw," he said.

"I bet you can," said Vashti.

"Me? No, not me. I can't draw a straight line with a ruler."

Vashti smiled. She handed the boy a blank sheet of paper. "Show me."

The boy's pencil shook as he drew his line. Vashti stared at the boy's squiggle, and then she said, "Please, sign it."

We'll come back to this story because there's a reason I chose this one to tell, but as I said, we'll come back. Let's start off with a little walk through the world of the early brain. So, the American Academy of Pediatrics, which is one of my professional homes, has an agenda for children they lay out each year, and they lay out their key priorities for what they'd like to do in the world of pediatrics. And as you can see in this slide, one of the key priorities they had from a few years ago and that we've just finished integrating into the academy is the idea of early brain and child development. I served on this leadership group at the academy nationally, and this is our motto -- "Building brains, forging futures." But it was actually our subhead that I actually think is more important -- this idea of, "It's all about nurturing relationships."

And you'll hear me come back to that point about relationships over and over. There's an urgency to this. We have too many kids that are really not doing well. They're not receiving the right stimulation from the earliest days of life, and we're seeing the consequences both for themselves, their families, and for our society. There's also the essential role of "Us." And when I say "Us," I mean any of us that touch children, that touch families, that really make a difference in their lives. We see what happens when policies and programs don't work well and don't work right, so it's up to us to also speak up and make sure that those who do make policies and programs hear that. So, in 2007, the National Scientific Council on the Developing Child came out with a report called "The Science of Early Childhood Development."

What they tried to do was take these ideas, this research from decades and say, "Let's try to distill this down into some key points that we can use to drive policies, we can use to drive programs that ultimately will help people." And I want to share those points with you because I think they are so important. The first thing they did was to come out and say, "Child development is a foundation for community and economic development." Now, you know, many of us are not thinking of kids as future potential economic units, right? We just say, "Hey, they're kids. You know, this is what we do."

But the thing is these kids are our infrastructure. They are our future. They're our future employers. They're our future inventors. They're our future service providers. They will do all these things. And when we don't invest in the infrastructure of the young child's brain, we are basically saying, "Our society doesn't have a future. We're not investing in our future." In the same way we're putting away money for highways and bridges and things like that, we need to be thinking of a brain infrastructure, as well, as a key economic development piece. Number two -- Brains are built over time. There's sometimes this idea that, "Oh, if we put all of our money into one critical area, of one time period, it'll all be okay." Well, no, you can't put all your money in the first year of life and say, "Okay, great. We're done. There's nothing else we have to do here." Nor can you put all your money later on. A lot of folks like to put reading intervention program at third grade because we measure it in the fourth grade, right? So let's intervene in the third grade. But what about the eight years of a child's life before that? You know, you can't just ignore that, as well. We need to take the long view. There's kind of a three-legged stool for predicting the trajectory of a child's development. One is the biological factors that we look at all the time in health care. That is important. But just as important is the socioeconomic environment.

The zip code a child is born and brought up in may matter more than their genetic code in terms of their eventual outcomes. And that is really critical to recognize and to try to intervene around. But we've known this for a while, but what about the micro environment? What's the attachment and relationship patterns that the child has with those around him? That's just as important as the bigger socioeconomic environment. Who's at home? Who's in the child-care center? How are they interacting together? All those sorts of things make a difference just as much as the other two factors. And that brings me to the third point from the report. There are two things that affect the developing brain that literally have an effect on how those neurons are wiring, and that's genes and experience.

And I like to think of this as being like a campfire. You need both that wood, and you need that spark in order to get that flame going. You can't have one without the other. Now, we can't modify genes so easily. We'll come to that. There are some ways to do that. But we can modify experiences. We can mold experiences to what we do with policy and programs. So, if we had to look and say, "What is the active ingredient? What is the factor that makes the biggest difference in terms of how that brain is wiring?" It's the serve and return nature of relationships. Serve and return, like in tennis -- When you toss that ball, hit it, and it comes back.

That back-and-forth nature of interactions is absolutely critical. That all comes down to children's engagement in relationships with others. So, to drive this point home, I'm going to share a short video with you. I used to work for Ed Tronick at the Child Development Unit at Children's Hospital in Boston when I was in undergrad, and he had this face-to-face paradigm that he created. He'll explain what that is in the video, but I want you to see what happens when interactions go well between a parent and a child, what happens when they don't go so well on a short-term basis, and then when it's short, how quickly they repair. Again, I'll let him explain.

Edward Tronick: Babies this young are extremely responsive to the emotions and the reactivity and the social interaction that they get from the world around them. This is something that we started studying, oh, 34 years ago when people didn't think that infants could engage in social interaction. In this "Still Face" experiment, what the mother did was she sits down, and she's playing with her baby, who's about a year of age.

Mother: Oh, my good girl. Oh!

Edward: And she gives a greeting to the baby. The baby gives a greeting back to her.

Mother: Yes!

Edward: This baby starts pointing at different places in the world, and the mother's trying to engage her and play with her. They're working to coordinate their emotions and their intentions -- what they want to do in the world. And that's really what the baby is used to. And then we ask the mother to not respond to the baby. The baby very quickly picks up on this, and then she uses all of her abilities to try and get the mother back. She smiles at the mother. She points because she's used to the mother looking where she points.

Girl: [Coos]

Edward: The baby puts both hands up in front of her and says, "What's happening here?"

Girl: [Whines]

Edward: She makes that screechy sound at the mother.

Girl: [Screeches]

Edward: Like, "Come on. Why aren't we doing this?" Even in this two minutes, when they don't get the normal reaction, they react with negative emotions. They turn away. They feel the stress of it. They actually may lose control of their posture because of the stress that they're experiencing.

Girl: [Crying]

Mother: Okay! [Inaudible] I'm here. And what are you doing? Oh, yes! Oh, what a big girl!

Edward: It's a little like the good, the bad, and the ugly. The good is that normal stuff that goes on, that we all do with our kids. The bad is when something bad happens, but the infant can overcome it. After all, when you stop the still face, the mother and the baby start to play again. The ugly is when you don't give the child any chance to get back to the good. There's no reparation, and they're stuck in that really ugly situation.

Dipesh: So, I used to code these videotapes as an undergrad, and the hard part was not seeing interactions like that one. That was actually a pretty typical interaction. The baby got upset when they weren't receiving the expected stimulation, the back-and-forth from the parent, and so on. The hard part was actually when the parent would go into the still face and the baby wouldn't do anything. Now, why might that be? It's because that child wasn't used to getting that stimulation. That back-and-forth play was not something that they expected. I don't believe for a moment that any of the parents in our study were setting out to be bad parents, they wanted to ignore their kids, or anything like that. The thing is we think of this back-and-forth interaction as being natural and instinctual and so on. The reality is that it's learned behavior.

We learned it because other people around us did it. It was modeled for us, and we incorporated that without actually recognizing that. And in families and in communities where this may not be happening as much, this doesn't become something that you think that, "Oh, I should do this with my child." The other part of this -- The other dynamic that sometimes goes on is that for parents who've suffered in

terms of their own educational attainment, they may be thinking, "You know, I struggled in school. What is my child going to learn from me?" You know, "Wouldn't they be better off in front of this 'educational' TV show or something like that?" The answer is no, they're not. They need people interacting with them, not TV. But again, a parent could be forgiven for thinking that maybe they're better off in front of this thing that's being purported and sold to them as educational and so on. There's also sometimes an idea of, "Oh, my child isn't speaking yet. Why would I speak to them? I'll talk to them when they learn how to speak." Or, "They're not reading yet. I'll read to them when they know how to identify letters," or things like that, and not recognizing the critical role the parent plays in helping actually get the early parts of that going and moving along. So I think there's a lot going on there.

All right, the fourth point. This is straightforward. You need simple circuits and skills in order to do more complicated things. So when people say, "Why are we spending money on kids playing with blocks?" or whatever the case may be, it's because, as T. Berry Brazelton said, "Play is the work of infancy." This is a child's job, is to be able to play so they can develop these skills so they're able to build more complex skills and circuits later on. The fifth point we're going to spend a little time on. This is this idea of toxic stress. Now, toxic stress, which we'll define more carefully in a moment -- When it happens in early childhood, it's associated with these persistent effects on the brain, the stress hormone systems, and so on, and that can damage the developing architecture of the brain. And it can really lead to lifelong problems, not just in mental health and behavioral health, but also in physical health, as we'll see.

Now, you don't need to be a radiologist if I show you these two head C.T.s to see there's a big difference. These are both 3-year-old children. The one on the left is developed as a typically developing child. The one on the right is a child who underwent extreme emotional neglect, okay? Not physical neglect, but emotional. They were bathed and washed and fed and all that, but no one talked to them, no one sang with them, no one played with them. This is a child who was in one of those large 1980s Eastern European warehouse-style orphanages where there just wasn't enough people to interact with them. You can see that that brain on the right looks -- The head is smaller, the brain is smaller. It looks shrunken. It doesn't look as dense with neurons as the one on the left there. You can see that pretty easily.

And there's more subtle changes that we'll come to in a moment. Now, let's talk for a moment about the stress response. We talk a lot about stress in our society -- work stress, home stress, you know, all that. And when we have a stress response, we have some things happen neurologically, but we also release two hormones -- epinephrine and cortisol. Epinephrine is what we also know as adrenaline. Your heart beats faster and stronger and all that. Cortisol is a little more mysterious to most people. It is, again -- It's often known as a stress hormone. Now, what happens when -- You know, stress is not necessarily a bad thing. Small amounts of stress are actually how we adapt to changes in our environment and learn and be able to move along. If you have zero stress, there's zero reason to change, and that's not good for any sort of biological organism. Animals have stress responses. Even plants have a type of stress response.

Now, cortisol is interesting. It kind of -- It works really well short-term. So, let's imagine you're off in the woods and you fall and you twist your ankle and you really did a number on your ankle. So, what does your body do? It makes the area hurt so you don't walk on that ankle and cause more damage. It

causes it to swell up so there's more blood and other things and other factors coming to that area to help that ankle heal. Cortisol is not released yet. You're sitting there. You've got this ankle. Okay, whatever. Now you, all of a sudden, see in the distance a bear. Uh-oh. Your ankle does not matter now. Your ankle's not going to do much good if it's inside the bear's stomach, so you don't want that pain. You don't want that swelling to go on at that moment. So what happens? Your body starts to release epinephrine. It releases cortisol. What does that cortisol do? It tells the body, "Don't swell. Don't hurt." This is like hydrocortisone cream you put on, like, a rash or something. It dampens inflammation. It does the same thing in your ankle. You're pumping out cortisol so you can make a run for it, climb up a tree, whatever you need to do to save your life.

Later, when the threat is gone, that cortisol's going to go away. The pain's going to come back, and your body can get on with it. This is a really good system for short-term preservation of your life and critical situations like that. It's a really crummy system for dealing with long-term issues, and we'll come to why. So, you can think of three levels of stress response. One is positive stress. These are small stressors. It helps you adapt and change. Your heart rate goes up a little bit. You release a little bit of stress hormone. I like to joke that this happens every time I give a talk. And this is a good thing. You don't want me falling asleep up here, forgetting what to say, et cetera. This is how you learn and adapt and change and so on. Then there's tolerable stress. These are serious stressors. They're not necessarily minor, but they're temporary. The stress levels go up, and then they come down after some point. And importantly, they're buffered by good, supportive relationships, either socio-emotional relationships -- "Hey, I hear you had a rough day, Want to talk about it?" -- or practical aspects of relationships -- "Hey, I heard you lost your home. Do you need someplace to stay?" You know, or some combination thereof.

Now, toxic stress is not a single bad stressor. It can be, but it usually isn't. It may be the same thing as tolerable stress, except the stress levels stay up for prolonged periods of time and they don't ever really let up and there's few or no protective relationships. And that's really important. That might actually make the difference between what's tolerable and what's toxic -- whether those supportive relationships are present in some substantial manner or not. And you can actually think about toxic stress as being a way that health disparities are transmitted between generations, because if you've undergone toxic stress, you don't develop the skill set to be able to counter that, and that can get relayed to the next generation because they won't necessarily learn that, either, and so on. Okay, so in a child's life, what are examples of positive stress? Well, I'm a primary-care pediatrician. I work in a community health center with a low socio-economic status population. Here's one that I cause all the time, which is someone shows up to give them their shots, okay? And what does the kid do if they see those shots and they're old enough to know what they are? They start to cry. They're anticipating a painful event. They have a stress response. That's normal. That's what we'd expect. Parent leaves on the first day of preschool, and the child cries. Again, you expect that, because if you're in the mall with your 2-year-old and they get separated from you, what do you want them to do? You want them to cry so that someone says, "There's a kid here on their own crying. I better call security and, you know, make announcements."

You don't want that kid to go behind a large potted plant and play quietly for the next two hours while the whole town's out looking for them, right? Although that happens sometimes, too, you know. So these are examples of positive stressors. Tolerable stress -- Again, these are bigger-ticket items -- death in the family, a serious illness, natural disaster. These are the sorts of things that are tolerable because

they're hopefully short-term. But what if it's worse? What if those supportive relationships aren't there in a substantial manner? These are things like child abuse. Child abuse, sadly, tends not to be a one-time event. It's often part of a longer, larger pattern. Parental substance abuse -- same thing. Homelessness. Most people are not homeless once. They're dropping in and out of homelessness or on the edge of homelessness for a long period of time. These sorts of things, when they happen early in a child's life, because of the huge effect they have on the child's brain and their physiology are what we call toxic stress because of what they do. So what happens? This loop happens. You have childhood stress.

This leads to a chronic fight-or-flight. That short-term stress response becomes chronic. And this means all these stress hormones are being pumped out all the time. This actually changes the architecture of the brain in a way we'll come to in just a moment. The result is that the child has decreased common coping. They have this hyper-responsive stress response. They're always waiting for the next bad thing to happen. That leads to more stress. And this whole thing turns into a cycle over and over and over. Okay, so, what actually happens with the brain? Bear with me on this. This is the one slide where we'll talk about different areas of the brain.

There's three things I want to focus on. One is the amygdala. The amygdala is the worrywart of the brain, okay? This is your self-preservation, your fear, your act instinctually, all those sorts of things. And in children who undergo toxic stress, early adversity in the first years of life, we're able to show on MRI scans that their amygdala are actually larger. Much like a muscle, the more it gets used, the larger it becomes. Now, countering the amygdala are two areas. One is the prefrontal cortex. This is your planning, your delayed gratification, your thinking through things -- all those sorts of things, executive functioning, all that. In kids who have undergone toxic stress, you see that there's less neural density in the prefrontal cortex. You also see that when you do functional MRI, which shows how active that part of the brain is, there's less function in their prefrontal cortex. And then you have the hippocampus. The hippocampus plays a role in memory and mood, and we can actually measure the hippocampal volumes very easily on MRI. And we see that the hippocampal volumes are smaller in these kids who've had this early adversity.

So, you see that there are these changes. And this work, by the way, is being done by Seth Pollak right at my own institution. Never met him, actually, but cite his work all the time -- where they're imaging kids in the lab and comparing it to what their experiences are. And actually, there's a paper released this week on that that I haven't even had a chance to read yet, but that, again, amplifies this work. So, what are the implications of this? Because I don't go loading kids into an MRI scanner when they have behavioral issues. It's not going to give me useful information. It's an expensive test. You know, it's great for lab research, but it doesn't help me in the real world. So, think about what sorts of things we see. I get referred -- a lot of kids referred to me by schools, by parents, et cetera, and they come in with a variety of behavior issues. What do I hear? I hear that this child is impulsive. I hear that they can't plan ahead. I hear that they're anxious. I hear that they can't delay gratification, that their mood is labile, and that their memory is pretty bad. Now, you may say this sounds a lot like what we call ADHD.

Well, you know, I have patients with ADHD. And with classic ADHD, what I find is the kid's trying, the school's trying, the parents are trying -- Everyone is trying, and the kid just cannot pay attention. You give them a little dose of medication, and they actually take off and do really well. They actually do

incredibly well, and everyone's happy. That's classical ADHD. That is probably five of my patients. Not 5%, but 5. The vast majority of the patients I see with behavioral problems, and there's a lot of them -- When I go digging in their histories -- and I start prenatally and walk all the way through to the present day -- I discover that the child witnessed domestic abuse. I discover there was substance abuse in the home at some point. I discover they were homeless. I discover there was food insecurity and so on and so forth. And medication will help with their attention problems, but only a little bit. It's really not going to fix everything. This is not just ADHD. What I'm really seeing are the brain effects of adversity over time. Now, there's no magic pill, there's no magic cure to make that go away, which is why I focus so much on the prevention side, as you are hearing from me. Now, as many of you know, we screen kids for lead because we know that lead is neurotoxic and can really affect their learning. I want to make the case to you that poverty is neurotoxic, as well.

Two studies I want to share with you. They're unrelated studies, but just bear with me. In one study, they looked at 4-year-old children, and they were enrolled in Head Start, and they saw that when you measured their salivary cortisol -- Why did they do saliva? Because you cause a cortisol spike when you start waving needles at children, right? So they did saliva. They measured their executive functioning. They did formal testing. And then they asked a teacher to rate the child's self-control in the classroom. So, this is what we saw. The blue line is a normal response, okay? Stressor happened, and the cortisol goes up. Stressor goes away, cortisol goes down. So, we saw that those kids had higher executive functioning and were rated as having more self-control in the classroom. Those with any other type of cortisol response -- this chronically high, chronically low, or blunted -- we saw that they had lower executive-function scores and had poorer self-regulation skills. So there was some connection between the cortisol, the stress-response system in these 4-year-olds, and classroom behavior and formal performance on testing, okay?

Now let's look at a second study -- again, unrelated. This was mother-infant pairs -- 1,200 of them -- and they watched the moms playing together with the child. The moms who did scaffolding play -- Now, scaffolding play is a term some of you may know, but just to review it briefly -- Scaffolding is when the parent sets up the play environment for the child, but doesn't actually guide what happens next. That is actually up to the child to do. So, for example, you take the shape sorter, and the mom takes the circle and says, "Oh, look, it's a circle," and puts it in the circle. And the baby says, "Huh," and takes the triangle and promptly tries to put it through the square, okay? And, of course, it doesn't go. In scaffolding play, mom is going to hold back, and maybe baby tries a different hole. Maybe they try to re-orient the shape. Maybe they try a different shape. Maybe they lose interest. Maybe they get frustrated and start to cry. Any of these are outcomes, but mom is setting up the scaffold, but she's letting baby decide what happens next. The other dominant play style is what we call an authoritarian play style. Same setup. Kid takes a triangle, going for the square, and mom says, "No, no, no. That's not right," and guides their hand to the correct answer. Now, the shape sorter is not about the correct answer. The shape sorter is -- You know, no one's doing your college admissions based on your shape-sorter performance at age 2. The shape sorter is about fine motor skills. It's about spatial relations. It's about hypothesis testing. It's about curiosity. It's about persistence, all that. It's not about the right answer.

But the child who gets the authoritarian play style doesn't really have the opportunity to do that in the same way. So, the moms who did the scaffolding -- We saw that the children had lower cortisol levels and paid more attention to what was going on. Those who did an authoritarian play style -- Those

babies had higher levels of cortisol and seemed to be paying less attention to what was happening. When did we see this? 7 months of age in this study, and it held up through 15 months of age, which was the study period. And the kicker was the more impoverished the family, the less likely they were to engage in scaffolding. So, let's connect the dots on this. Something about poverty in a family is associated with changes in play style and interaction, which we also know from the face-to-face work and all sorts of other things. And that seems to be associated with cortisol changes in young children. And when you see those cortisol changes -- same types of cortisol changes in 4-year-olds, you're also seeing it being associated with classroom performance that is poorer both in formal testing and in behavior terms. Now, is that a lot of leaps and jumps and so on? Yes, it is. But the fact is that it's not news to anyone that children who live in poverty are more likely to struggle in the school system. We've known this for a long time.

What we're starting to see now are bio markers that help us say what's the biological connections that we can use, that we can see where the issues are and perhaps figure out and measure and gauge our interventions in some way, shape, or form. There's still so much work to be done on this. It's nowhere near, like, "Gee, you can really design something beautifully on this." But, you know, again, we now have bio markers that are helping us there. So, we know that when kids have good experiences, that leads to good brain development, it leads to something called epigenetic changes that also influences brain changes, and we'll talk about that in a second. And that comes out as adaptive, healthy behavior, and that hopefully feeds to better experiences, as opposed to the negative equivalent of this whole cycle. So, let's talk for a moment about the term epigenetics. So I will tell you that the word "epigenetics" did not appear in my medical-school curriculum, which wasn't all that long ago. Now it's being taught in most medical schools, as well.

Now, there's a lot -- If you look up epigenetics, you'll see that there's all sorts of things, and they talk about all these mechanisms like DNA methylation and so on. Well, you know, let's talk about the big-picture aspects of it, though, because, as I say about epigenetics, it's really cool stuff, but I don't completely understand it, either. But let's talk about what it means. What are the implications of epigenetics? If you think back to biology class, you might remember there was a guy named Lamarck. Now, Lamarck said that giraffes got long necks because they would stretch up to reach the highest trees and be able to eat the leaves. And because their necks stretched, they changed their genes somehow and passed that trait on to the next generation. And over generations, their necks got longer and longer. Well, he didn't quite explain why that didn't happen to all animals, and only giraffes. And when Darwin came along, he said, "No, no, no. That's not how it works. Some giraffe that had a longer neck had a survival advantage at times of drought, and therefore, it passed this trait onto its offspring, et cetera, et cetera," and everyone laughed at Lamarck, and they said, "See?" This is what happens sometimes is that a theory is disproven when we have new information and so on, and everyone said, "Yeah, that silly Lamarck."

Well, the thing is, epigenetics tells us that maybe in some way, a little way, maybe Lamarck was kind of right, because you can't change genes, but you can change how genes are being expressed or interpreted. And that is really what epigenetics is. It's the study of which genes are turned on or off when and where. So, our structural genome -- what we think of as our genes -- is about 23,000 genes that we pass on to the next generation. The epigenome, though, changes and morphs over time, based on the experiences around us and the exposures, and it determines what genes are expressed. One way I like to think about it is that the structural genome is to the epigenome the way a computer's

hardware is to its operating system. Many computers these days, you can't really upgrade their hardware. They're kind of locked closed, et cetera. When you buy it, that's what you got. That's like our genes. But the epigenome is like the operating system. You can update it. You can change it. You can modify it, all those sorts of things. Another way to think about this is that identical twins have the same genome, but they may have different epigenomes, particularly if they grew up in different homes, because, again, it's experience that modifies the epigenome. So, over time, you... Sorry, my slides have suddenly frozen. Okay. So, the implication with epigenetics -- I think I might need to reboot this briefly because it's freezing for some reason. So, what happens with epigenetics -- We'll have the slides back in just a moment. What happens with epigenetics is that the implications of this is that when a child has these different exposures over time, they are able to do different things. The type of things that they're exposed to, that make differences, are toxins, are environmental influences like who talks to them, et cetera. All those sorts of things will affect their epigenome over time. And the -- Just give me one second here.

Okay. That affects the epigenome. This actually has implications for policy and for programs and procedures and how we do all those sorts of things over time. For example, thinking about child welfare programs, there's a lot of mandated maternal employment programs that are out there, saying that if you are going to receive certain benefits, et cetera, you need to go back to work. Well, when we also know that the first two months of life are important in terms of parents and children playing with one another, interacting with one another, and so on, are we actually shooting ourselves in the foot when those sorts of things happen over time? There's some states -- Wisconsin, where I am, is one of them, as well -- where they basically say, "Hey, there are" -- When a child is born on Medicaid and the father is not married to the mother, they go after the father and say, "We need you to pay for half of the birth costs" -- something called birth-cost recovery. Well, what happens with this is that sometimes what could have been a stable two-parent household actually becomes one-parent because the father splits or the mother does not want to identify the father, or something like that. You know, so, this has epigenetic implications for really what happens over time, and so on. So, this is really what the science is telling us over time, and we'll see more as more and more work comes out with epigenetics. Sorry, this is just being slow. It'll slowly appear here.

Okay. So, the other thing that I want to talk about here is also the implications of what happens with adults. Over time, adults -- We have to think about building the capacities of adults as well as those of children because adults are who are around children, and we want to make sure that they're able to deal with things, that they're able to come up with issues, and so on, and be able to easily make sure that they have the abilities they need. We sometimes talk about the difference between capabilities and capacities in families.

All right. Sorry about the delay there. I'm just going to plug this back in. Okay. Okay, we should be good. Thank you. Okay, sorry about that. I'm going to come back to the capabilities issue in a moment, though, because I want to talk about the adverse childhood experiences study, which a lot of people haven't necessarily heard about, although I think, actually, folks in early childhood are far more knowledgeable about it than those of us in the medical community. But that's why I call it the most important study you've probably never heard of in many settings. This study basically looked -- They discovered that there were adults who were having issues later on in life, and that many of them had histories of abuse or trauma over time. So the CDC and Kaiser looked at a huge number of patients and tried to say what happened in terms of childhood trauma and what happened later on. Now, I want to

highlight something that I think even people who know about the A.C.E. study are sometimes not necessarily thinking about. This was a study of middle-class Americans. They were in the San Diego area, mostly Caucasian, mostly college-educated, in their 50s, and split evenly between men and women. This is not an impoverished, at-risk population. People say, "This is what happens when you live in poverty. That's what the study's about." No, actually, it's not. Now, they looked at these different types of factors when it came to adversity in childhood -- different types of abuse, neglect, household dysfunction, and so on.

These numbers appearing on the right are the prevalence in this society -- in this cohort. You can see these are much higher numbers than you'd expect. 26 percent of them said that they were physically abused at some point in their childhood. 26%. This was much higher than anyone ever expected. Even the smallest number on there -- 6 percent for incarcerated household member -- in a busy adult-medicine practice, that's one patient or more walking in through your door every day with this in their background. Do we ask about it in health care? No. Should we be? Yes. And then people don't tend to have just one of these adverse childhood experiences. Sometimes they have more than one. So they came up with something called an A.C.E. score -- one for each of those categories we listed -- and you saw that 26 percent had just one. But look at this. Four or five or six of them? There was 1 in 20 for each of those.

So these were surprisingly high numbers, and I want to point out that this study's been repeated over and over and over, and we're seeing about the same numbers. There's state-specific studies that are also finding this. I was actually at a conference recently where they gave out the little clickers and went through the A.C.E. questions with the people at the conference. These were professionals in the field. We got about the same percentages. So this is not a fluke. So they found that these were unexpectedly common, but when you look at the outcomes, the effects were also cumulative. So, what did we mean by that? In the first three years of life, did they have some significant adversity that impaired their development? Was there developmental delay? Well, you can see, if you have five, six, or seven adverse childhood experiences, you have 75 percent to almost 100 percent risk of being developmentally delayed in the first three years of life.

The next slide is the one that blew my mind when I first saw it. This is your risk for adult heart disease. If you had seven or eight adverse childhood experiences, you had three times the odds of heart disease as an adult. This is like 50 years later. If anything else tripled your risk of heart disease, you can bet that the drug companies would be on that, right, trying to figure out, "How can we figure this out here? Oh, it's adversity. Never mind," you know? Even small increases in adversity and adverse child experiences can make a difference. The three bars here -- the light gray is no adverse childhood experiences. The medium gray is one. And the darker gray is two or more. You can see the risk of major depression goes up, something called CRP, which is a marker of inflammation in the blood, which is also associated with heart disease and stroke risk, also goes up. Other metabolic risk markers go up. More than one chronic disease, hypertension, diabetes, and so on -- All of these go up. So there's really a lot that goes on there. But we know, coming to the last point from the report, if we create the right conditions for early-childhood brain development, we know it's more effective and less costly than trying to address these problems later on in life. So let's think about what this means in terms of progress. You have children who start at birth and going to age 5 in this graph. We have our healthy kids. These are the ones that are doing well and so on. And you want them to stay on that trajectory. You have your high-risk kids. These are the ones who you can label easily as high-risk. This is your ex-26-week preemie. You

know they're at the risk for developmental delay. You can put a label on them. You can make sure they get services. And then you get the kids I worry about the most. They're the in-between ones -- the at-risk kids. They're not so cleanly labeled. There's a lot of them out there. And we know they're also not going to do well if we don't do something.

The thing that's important to recognize is that adversity pushes down on all of these curves. It's not that you're magically immune if you're healthy. And since we can't snap our fingers and make adversity go away overnight, we need good protective interventions that will shield children from the effects of adversity in these early, critical first 1,000 to 2,000 days of life. So, what are these things?

A lot of things we already try to do. Good anticipatory guidance, reading together with a child, proper discipline, good health services, preschool. All these things will keep that healthy curve up where it is. For that at-risk kid, you can do all of that, plus you can do parental responsiveness training -- that parent who doesn't know how to do face-to-face. Well, we can make sure that they learn how. It's not actually real hard to train that and to teach that in a short intervention. Good language stimulation. Making sure the child is hearing words around them and at them from people, not products. The TV doesn't count. The iPad doesn't count. And then high-quality early-childhood education. And then for the highest-risk kids, home visiting, specialized services, plus all of the above, because, as Jack Shonkoff at the Harvard Center for the Developing Child tells us, there's some promising domains where we can make a difference in how we think about all of this.

One -- Reduce the emotional and behavioral barriers to learning. I have so many patients that are smart. They are brilliant. They are so intelligent. And they're flunking out of school. Because they have too much layered on top of their intellect, we will never see what their intellect can do. Number two -- We can enhance the healthy development of children by transforming the lives of their parents. This is a news flash to some people -- not to your folks, but, you know, children live in families. You can't help them without also helping their families and making a difference there. And then finally, realizing that all of what we do is really health and well-being. It's not just the domain of us and medicine or anything like that. We all have a role in this, and a very big role, because if you look at this graph from the U.W. Population Health Institute -- This is at the University of Wisconsin -- If you look at the factors that go into health, 30 percent are health behaviors, 40 percent are social and economic factors, and 10 percent is physical environment.

Only 20 percent is clinical care. We are a highly expensive 20%, and we still don't get great results because we're not necessarily always looking at that other 80%, because, for a kid to start school, we want them to come with a lot of different skills. This is what we hope they have -- ability to self-regulate and perspective take, communication, cause and effect, you know, motivation, all these things. It's the way I think of my job in primary-care pediatrics. Yes, I still do the ear infections and the runny noses and all that stuff day in and day out, but when I do regular check-ups, when I do well-childcare, my big job is this -- is that of developmental assurance. How do I help that family get their child from zero to adulthood with not just a healthy body, but a healthy brain and a healthy mind? Now, none of this is to say that children should be engaged constantly. They should be allowed to play on their own, down time, all that stuff. Bad things are not necessarily a long-term negative, and that children should get proper discipline. You're not going to cause toxic stress by putting your child into time out and so on. So, a few numbers to remember.

There are 700 new neural connections happening per second in the developing brain. We want those connections to happen well. Why? Because this idea of plasticity. And bear with me on the terminology for a second. The synaptic and cellular plasticity. And one is a variation in strength of the connections, the other in number, et cetera. Here's the key part -- synaptic plasticity is lifelong. All of us adults -- We are using synaptic plasticity to learn new things. Cellular plasticity, though, is already starting to decline by age 5. Yes, those Kindergartners are over the hill in one way, at least.

So, the upshot of this is this diminishing cellular plasticity limits our ability to do remediation. It's a lot easier to remediate a 3-year-old than it is to remediate an 8-year-old. 8-year-olds are quite remediable. Don't get me wrong. But you get so much more when you do that when they're 3. And forget the 3. You get so much more when they're 6 months, you know, and so on. You want to take advantage of this biological fact and not just wait. We can measure disparities in vocabulary at 18 months. This is really quite important.

So, look at this graph here. This shows three different socio-economic strata. The "Y" axis, the vertical, is the receptive vocabulary -- The ability of a child to understand words. Along the "X" axis there, the horizontal, is the age of the child from 10 months to 36 months. Look right here. At around 18 months, you can see the richest kids are already pulling away from their less-affluent peers. And by 24 months, the middle-class kids are pulling away from those living in poverty.

So, when we talk about the achievement gap in our society, this is not -- The achievement gap is not because middle schools didn't do their job right. It's not because elementary school didn't do their job right. It's not even because preschool didn't do their job right. Because all those things are, like, way off to the right-hand side of this graph. If we can measure it at 18 months, you know the brain changes are happening way back in infancy. We will solve the achievement gap when we learn how to properly address the first 1,000 days of life. And that is absolutely critical.

That's not to say you don't invest in preschool and schools and all that, because you need to support the gains that are made, but we need to make sure we're working early, early, early, because for every dollar we put in early childhood, we see \$4 to \$9 in returns. Who says that? Not me. James Heckman, Nobel Laureate in economics at the University of Chicago. He's made this his life's work, and he tells us that the programs that are targeted towards the earliest years have the best bang for their buck. Again, it's not zero for preschool or schooling or job training or anything like that, but the best returns are early on. And as Frederick Douglass said long before we had MRIs and Nobel Laureates and all that, "It is easier to build strong children than to repair broken men." All right, so, what can we do about this? Now that I've thoroughly depressed everyone with the situations and all the things that are out there, we will give you the solution. Well, no, not really. I'll give you principles of solutions, because there's no one magic solution that will fix everything. This is not like polio, where you could make a vaccine against one virus, and that was it. So, what are the things we need? We need solutions that do a number of things.

One, we have to build capabilities. So, this is what I started talking about earlier. The parent may not know how to do certain things. They may not know how to do that back-and-forth and so on. So can we teach them that? Sure we can. We also need to build capacities. The parent may know how to do those things, but they can't do it because they're working a second job or they're not home at night to read to their child. Who am I to tell them to give up that second job when that's keeping them from being homeless, right? So we need to figure out how do we build their capacity to do the parenting

tasks they want to do? We need to do things that are based in homes and communities -- You know, not make them go somewhere else -- address root causes, have long-term effects, use a prevention strategy, leverage those critical first 1,000 days of life, make sure that it's evidence-guided. Notice I say not evidence-based. There's not evidence for everything. And if we simply insisted on evidence, there's so many things we wouldn't do, period, ever. So use evidence where it's available, but use common sense otherwise. And we need things that we can take to scale. So, what are those sorts of things? Well, in my world, in clinical practice, this is something that the Early Brain and Child Development Group did at the American Academy of Pediatrics. We came up with a grid saying, using our well-child guidelines, what are the sorts of things that we would like pediatricians to talk about at well-child visits? And I'm going to blow up the title bars here.

Explore the child's environment. What can we assess during well-childcare? Helping build relationships to strengthen that parent-child bond. Teach parents about development and develop parenting confidence so that we can support parents as we nurture their child's development. Really taking a much more developmentally-oriented approach, rather than a technical medical approach. What about the clinic/hospital/home visiting? You notice I put question marks there, because I actually don't know that health-care places are the best places to do a lot of this sort of work. We can do different types of training and home visiting and programs like Play and Learn and Parent-Child Home and so on. But I think all of these groups -- home visiting, but especially health-care institutions, can benefit from poverty-aware approaches to care, recognizing that, you know, families may not be able to show up when you ask them to go to a clinic that's on one bus line that only shows up once an hour, or things like that.

You know, this happens commonly, including in my own institution. In the community, we can talk to people about early brain and child development. We can use different strategies. We can do community-based mentoring. You know, Big Brothers Big Sisters, after-school, little league -- It's not just, "Oh, isn't that a nice place for the children to be?" It's a way of providing another adult supportive relationship. And if you look at these stories of kids who, you know, grew up in poverty and still somehow did just fine and did really well, you'll often find in their stories there's often one key factor -- the presence of at least one caring, consistent adult in their life. Ideally, more than one, but at least one. Sadly, there's kids for whom there's zero, and that's what we're trying to get at. And does this actually affect the brain? And can we make a case for this based on the science that we have? Sure we can.

This one study looked at hippocampus volumes. So again, remember -- Adversity, smaller hippocampal volumes associated with memory and mood issues? So, this looked at the severity of depression in preschoolers and looked at maternal support. The upshot of this graph, which I won't spend a whole lot of time trying to unpack here, is that maternal support made a bigger difference to that child's outcome in terms of depression, in terms of their hippocampal volume, than the severity of depression. They could have very severe depression, but as long as they had good maternal support, there wasn't as much of an impact on the hippocampal volumes, again, in young kids. Outside the clinical realm, we can do other things, like intentional skill-building, which we'll come to in a second, early intervention, of course, and then working across the aisle, so to speak, with justice, foster-care systems, mental health, social workers, et cetera, and of course, advocacy. Because, when it comes to treatment, we don't have tons to offer.

It's really hard to get good evidence-based treatment, and it's really hard to get -- Even though you get that treatment, it's really hard for families to take advantage of that because the pressures in their lives are still there. They still are being asked to work three jobs, and they're still trying to hold things together, and they can't devote the kind of time necessary to be able to work on these things. This is a reality. It's not that all that magically went away. I'm going to share a video with you. This is from the Harvard Center on the Developing Child that wraps up some of these concepts and talks about this idea of building adult capacities. And I think it really helps us kind of re-frame how we think about working with children and families.

Jack P. Shonkoff: The social challenges that face modern societies, whether it's the ability to work productively, to be a good citizen, stay healthy, have their roots in early health and development. [Baby coos] A strong foundation in early childhood results in much better and more effective development later. A weak foundation really puts us behind. [Baby crying] The most important thing children need to thrive is to live in an environment of relationships that begins in their family, but also extends out to include adults who aren't family members in childcare centers and other programs. What children need is for that entire environment of relationships to be invested in their healthy development. [Crying continues] We've shown, from decades of testing interventions, that we can improve outcomes. But the magnitude of those impacts is not good enough. Science is now available to help us think about what we might do that might have a bigger impact than the best of what we've done before.

So we began to ask, "What could we be doing differently? What could we do to be smarter?" Children who are at the greatest risk for the poorest outcomes in learning and health and behavior are children who experience a pile-up, a cumulative burden of one after another after another of risk factors. And then the burden is more than any child could be expected to overcome. So we began to focus on the development of the adults. What could we be doing to strengthen the capacity of everyone who interacts with children? This led us to think about the kinds of skills you need to deal with adversity, these skills of focusing attention, planning, monitoring, delaying gratification, being able to solve problems, being able to work in teams, executive function, and self-regulation. They're also the kind of skills you need to create a well-regulated home and school environment in which healthy development and learning could take place.

[Horn honks]

[Siren wailing]

And then brain science started to tell us that differences in those skills start to develop in infancy based on the environment kids live in. So, how do those skills get built? Well, if you don't develop them early, how do you develop them later? Actually, you can build them later, because the period of flexibility and plasticity for this part of the brain doesn't fully mature until age 25 to 30. And then the light bulb went on. The reason we're not getting a bigger impact is not because we don't know about how to influence development, but because we're giving information and advice to people who we need to do active skill-building with. Skill-building by coaching, by training, by practice. But we're not doing that. So we now have developed this theory of change that says "We need to focus on the development of the adults who are important in kids' lives."

Mother 1: So, try this.

Father: How does that work?

Mother 2: That's a new idea.

Mother 3: [Speaks Spanish]

Jack: We need to focus on their skills, their needs, in order for them to be better, more effective parents, in order for them to be better prepared to be employable, which would enhance the economic stability of the family, which is also good for children. Second of all, we looked at many people in preschool programs and childcare centers, and we said, "What are we doing to build those skills in the providers that need skill-building, as well?"

And also, the community can help to build and reinforce the capacities that parents need. And the community also includes programs in which the people who work in the programs have sufficient skills. Third of all, what are the major sources of toxic stress in this community, and how can we reduce that? Moving it up to a policy level, how are our policies strengthening communities' abilities to reduce sources of toxic stress and caregivers' abilities to provide what kids need? The development of our human capital is our future. The development of a productive workforce is our future. The development of a healthy population is our future. This kind of future orientation is critical for healthy society. It's critical for a thriving business. It's critical for a successful environment of relationships to raise children. It's all about being able to plan for the future, to have a future. And that's why this is so important.

Dipesh: So, I want to highlight the important point that this intentional skill-building with adults is really, really important. In health care, we're really good at handing out information, right? I've never solved anyone's obesity problem by handing them a brochure, right? It's issues like, how do you find healthy food? How do you cook the healthy food? You know, how do you build those sorts of skills? That skill-building is really important, and I think this is a really important area where we can work with families. It's not an information deficit for many families, you know, that, "Oh, I didn't realize I wasn't supposed to put my baby to sleep on their back." You know, they've heard that over and over and over. But what if they then tell you, "My baby doesn't go to sleep unless they're on their stomach. Help"? "How do I help them build that skill to be able to slowly transition their child so that they are sleeping in a safer way?"

For example, and so on and so forth. So that's really quite important. The other thing is, I want to share with you some work that's very recent. So, I'm an Ascend Fellow of the Aspen Institute, and one of my fellow Ascend Fellows has done some wonderful work on neuro-biologic change. So, we all know that infants -- Their brains are so plastic, and, you know, we can make such a big difference by these interventions that I've talked about early in life. It's also known, although less well-known, that adolescents are undergoing a lot of reorganization in their brain, and that's another place where you can create new skills and new capabilities and whatnot, is during this period of adolescence.

Well, what this work shows, done by Sarah Watamura and her colleagues in Denver, is that new parents may also have reorganization going on in their brain, interestingly enough, which is a lot of the parents that we work with, of course, when they have young children. So, a lot of parents tell us, "Yes, I'm really concerned about my child in their first year of life." A lot of anxiety and concern. That's normal. We hear a lot of that. Even in low-risk families, there's a lot of demands -- Financial demands,

sleep deprivation, changes in the relationship between the parents, and so on. So we know there's difficulty managing the stress of the transition. And when they don't manage it well, there's a risk for harsh parenting, risk for relationship difficulties, and for postpartum mood disorders. So, there are three circuits that we can look at.

One is the reward circuit, and we know that new moms and dads, based on her work, during the first few months postpartum, actually show different changes in the growth of their reward circuit. And the more positive feelings that moms report about their baby -- that they're beautiful, they're perfect, et cetera -- we see more growth in that rewards circuit. And you see more brain activity when they looked at pictures of their own infants, okay? So we're seeing this reward circuit, actually. When there's positive things going on, we see it really doing well. Now, another circuit is what we call the social-information circuit. And we also see changes there. More responses to when infants cry, or images of their infant that, again, they're being more responsive to that.

Again, it's a way of conveying information socially between people. And this may support the understanding of infant emotion and social cues during these interactions in an appropriate response. You know, what do they do when their child cries, when they're showing hunger cues, all those sorts of things? And then the third circuit that they look at really looked at emotion regulation, that there's less physical reactivity to the social and cognitive stressors around them in this new postpartum period. And again, more activation when there's infant cries in these regions, as well. Moms who had more of that oxytocin, which is associated with the birth process, but is also associated with social connections, also had less reactivity in their amygdala -- Remember that fear center that I talked about -- when there was negative emotional stimuli.

So, again, this almost reminds you of, like, a nesting or cocooning type behavior, that you kind of close off the bad things around you in order to focus on your infant and your infant's needs. These are all things that they've managed to show, which is really, you know, quite amazing. I think there's going to be so much more work to come out of this lab and others about looking at parents, but we've never really recognized that parents have neuro-plastic changes going on, and that, again, working with parents in the first few months of life, again, may yield better results than waiting till the child is 2 or 3 or even later on. Again, not that parents can't learn later on, but still. All right, so, to kind of wrap this up, you know, recognizing that we can use this public-health approach to building healthy brains, because we know that some kids will fall. So we need a net to catch them.

And that big net that we have -- that we can afford to have a big net, although it has big holes -- is the universal primary preventions -- things we do with anticipatory guidance, social supports, childcare, Reach Out and Read, which is the early-literacy promotion program that I do a lot of work with. I am the medical director for a state affiliate, and also on the national board for Reach Out and Read, where we encourage families to read together with their children from the earliest days of life and give them a book and use that as a tool to structure and scaffold, you know, talking about dialogic reading and other capabilities.

This large net will hopefully catch most of those kids, but, again, there's large holes because we can't afford one that has small holes. So some kids will still fall through, and that's where your smaller net with smaller holes comes in. And that's your screening, your targeted interventions. Home visiting, Head Start comes here, early intervention, and all that will catch the kids that make it down to that level. You still got a few that are going to fall through because, again, the system's not perfect. That's

where your smallest-holed net comes in. It is a tiny net because we can't afford that net at a larger scale. That is your evidence-based treatments -- all the other things we've talked about that hopefully are only having to deal with a small number of kids. So, we have the five R's of early-childhood education. This comes from an AAP report. Again, breaks it out very simply -- What do we want kids to be able to receive? First "R" is routines. What to expect of us and what is expected of them. Reading together daily.

Rhyming, which is the interaction, the playing, the cuddling, and all. Rewards for everyday successes, because praise is so powerful. And then relationships that are reciprocal and nurturing. Because, when we started our talk together today, you might remember I read to you from "The Dot." Why did I pick that book? I picked "The Dot" because it's a good story about a supportive teacher and how she worked with a student, Vashti, who just felt she couldn't do it. And she needed encouragement. She needed someone praising her, providing her with some scaffolding, and, boy, did she take off and fly, right, and did all those wonderful things. But Vashti also had something else happen. She learned how to encourage someone else. And she passed that on to that boy who couldn't draw a straight line. In a sense, this was intentional skill-building. This is about social relationships. This is about what happens when you pull all these things together. And that's why I like that story when I'm talking about the early brain.

The business community is slowly realizing that this is something they have involvement in, as well. Groups like Ready Nation, they're recognizing that their future workforce, if they want a skilled workforce, that they need to think about this from the earliest ages, as well, because when it comes to public investment, even though the brain's capacity to change is greatest early on in life, our public investment in programs that change the brain, which includes remediation, rehab, all that, is greatest later on. We need to change that. Can we make changes? We certainly can. In Wisconsin, even though we've had a deeply divided legislature for the last four years, we passed a joint resolution in our Senate, and then it went to the Assembly.

It actually passed our Senate unanimously and then went to the Assembly and passed unanimously. Now, this doesn't happen in our political environment these days, okay? What was this thing? Well, I'll read you the resolved clause. You can look this up easily by typing "Wisconsin Joint Resolution 59 2013" into a web browser, but I'll read you the resolved clause. "Resolved by the Senate, the Assembly concurring, that policy decisions enacted by the Wisconsin state legislature will acknowledge and take into account the principles of early-childhood brain development, and will, whenever possible, consider the concepts of toxic stress, early adversity, and buffering relationships, and note the role of early intervention and investment in early-childhood years as important strategies to achieve a lasting foundation for a more prosperous and sustainable state through investing in human capital." I might have written two-thirds of that.

I worked closely with the Senator who introduced this. It went through now. It's a resolution. It's not a law, so there's no money tied to it. There's no force of law. But we were the first state that came out with a really clear-cut statement like this. California has followed. Arizona is trying. There's a few other states that are looking at this. And if nothing else, it's like a chess match, right? You got to think several moves ahead. And I encourage anyone -- I actually kept the names of programs out of this while resolution. This wasn't about Reach Out and Read or anything. It was about those who work with children in early childhood. And anyone who does that sort of work can take this, meet with our state

legislators, and say, "Hey, you know, this -- You guys passed this. My program does this stuff. Help us," you know, and so on. So, it was meant as a gift to the early-childhood community. And that's why I put the success kid up there. Slowly, piece by piece, we are slowly winning. There's one last video, which I will skip, but all of these videos -- The URLs are in the corner, and they're on YouTube, so you can watch them at your leisure. But I will go ahead to my closing quote here, which is from the Sutton Trust, actually, in the United Kingdom, which I just adore.

"While schools can do much to raise achievement among children who initially lag behind their peers, all too often, preschool gaps set in train a pattern of ever-increasing inequality during school years and beyond. Any drive to improve social mobility must begin with an effective strategy to nurture the fledgling talent in young children so often lost before it has had a chance to flourish." And that is the job that we all do together, piece by piece. This is my wife reading to my son many years ago. I caught them in this lovely moment of being lost in a book together. And it reminds me of the power of relationships. It reminds me that children are made readers in the laps of their parents, as Emilie Buchwald said, and that parents are their child's first and best teacher. And the role we have to support them in that role, to help them build those skills is really incredibly important. My e-mail address and my social-media links that are public-facing are up here, if anyone's interested in following along. And with that, thank you for having me. And I'm thrilled to take the questions that you have. And thank you for listening.

[Applause]

Moderator: Thank you, Dr. Navsaria. "Children are made leaders in the laps of their parents." That sounds awesome. That's a beautiful quote. So, we have lots of questions for you today. And I'll start with a question from Christy. "I'm thinking about some of the families that I partner with. What can you tell us about self-medicating as a means of mediating a response to toxic stress? Is there research that could be referenced?"

Dipesh: Self-medicating?

Moderator: Yes.

Dipesh: Okay. I'm assuming by "self-medicating," they're referring -- Moderator: Alcohol.

Dipesh: Yeah, parents using alcohol, et cetera. You know, again, that's a great -- not a great, but it's a short-term response. Long-term, it's, of course, terrible because it doesn't actually address the root cause. And I think because of the difficulty in accessing high-quality mental health and so on -- I mean, it's hard enough for kids. It's hard for adults. That what happens is that parents are turning to whatever they can do when they can. We see this in teens, too, with un-recognized ADHD, that are essentially self-medicating through the use of un-regulated substances and so on. And that's certainly an issue, and it makes them -- it increases the risk that they're emotionally unavailable for the child, around other things, and so on. It's a big issue.

Moderator: Okay. Emily asks, "Are some epigenetics, or genes, more susceptible to experiences than others?"

Dipesh: Ah, that's a great question. The answer is probably yes. And I don't think we know enough about the nuances. You know, there's so many different factors that go into what turns a gene on or

off, how strongly is it turned on or off, and so on. We're only just, you know, in the last, what, five years, finally at the point where we've actually mapped the genome. And now we're saying, "Hey, wait a minute. We need to figure out how these genes are expressed." So I think we're a long way from knowing exactly how. What we do know is that the fewer exposure to toxins and the better the exposure to environmental influences, like relationships and so on, that that will -- that does have a positive effect overall, so we should just continue to work with those whenever possible.

Moderator: Right. Thank you. We have a question that says, "In terms of caregiving strategies, should we approach babies who are undergoing chronic stress differently than if they had a specific traumatic incident?"

Dipesh: I don't know that I would set aside chronic versus a specific incident in -- When we say "babies," I'm thinking of infants. In an older child, that's a little bit of a different story. So, if there was a specific, single stressor -- Let's say everything else was fine about their life, and there was a specific traumatic event, you may worry about something like a post-traumatic stress disorder, something that's triggering or setting off that child. And then I think working with their mental-health providers in trying to figure out what that might be. Maybe it's a certain approach or a phrase or words or something that, you know, might be something that, "Oh, that's going to trigger this child." That's different from a child who has just this chronic, un-remitting toxic stress where, frankly, the whole world, essentially -- They're waiting for the next thing to go wrong. I think that needs to be done carefully in coordination with their mental-health provider because it's a little too simplistic to say, "Oh, you know, this child was exposed to blank, and therefore we just shouldn't do this." Well, that may or may not be the case. And I think that needs to be -- That's careful coordination with their health providers if that is the case.

Moderator: Great. Thank you. Jill asks, "What advice do you have to break down the silos that impede addressing poverty in fostering optimal child development?"

Dipesh: That's a big one. So, I think that silos between different professions is actually a huge, huge problem. We don't talk to each other well. And some of it comes from pressures within our own world. You know, the medical world is sadly -- It's a business, you know. It's a lot about how many patients can get seen and revenue and insurance and all that. And even though many of us, especially in pediatrics, we want to do the right thing for children and families, we also have financial pressures that are being pushed on us by a large system. So I think recognizing that we all have these different approaches and these different pressures on us is important. So, for example, there are communities that'll say, "You know, we always invite the pediatricians to our meetings of our child early-learning collaborative, and they never show up." "Oh, when did you send out the invitations?" "Oh, we sent it a whole four weeks in advance." "Well, guess what, our clinic schedules are done three months in advance." And we can't just go lightly changing around patients and all. So, it becomes important, I think, to recognize these pressures, just to get people into the same room, and then to respect one another's different viewpoints and opinions to say, "How can we do this, and how can we do this effectively so we know what each other does, but also that we're able to create situations where we can effectively collaborate?" Quick example -- I love home visitors. Home visitors do so well for my patients and families. There's not enough home visitors to do what we need. But it's really hard for me to talk to a home visitor because I need to go back to my desk, hope for a free moment, which is usually while I'm eating my lunch and trying to get charts finished and everything, and get them on the

phone and hope they don't call back when I'm in the room with a patient and, and, and... Versus if I had an embedded home visitor in the clinic that I knew they were going to be there even once a month or once every two weeks, that I could, say, carve out a little time and say, "Hey, let's talk about those eight families of mine that you have." Wow, that would create the opportunity for that discussion and collaboration without me trying to say, "Oh, never mind. I probably don't really need to talk to them," and things like that. So, I think it's those sorts of things where we're moving just beyond mere collaboration, moving to almost a collective-impact sort of model.

Moderator: Wow. Very nice. A question from Michelle. She says, "How can early care and education providers build resiliency in children who have experienced A.C.E.s?"

Dipesh: Mm-hmm. Building resiliency is a really interesting topic, and I don't think we know enough about where that seems to come from. There's some really fascinating work, which also kind of merges with the epigenetic work, about resilient children. And one thing I'd like to point out is they showed that highly-resilient children tended to do better in stressful environments than those who were low-resilient. That's not to say either of them did great, but it's saying they were less affected. But those same high-resilience children also seemed to have a harder time doing well in good environments. So it's not just resilience -- You know, we think of resilience as being, "Oh, we all want to be resilient," but it's almost how much your environment can influence you. So there's also a downside to resiliency in a sense.

To answer the direct question of what can we do, you know, to really help those kids, I think trying to be consistent. So, whenever possible in early-childhood education environments, making sure we're not switching up teachers all that often, to make sure that maybe there's a consistency of teacher from year to year. Again, that caring, consistent adult theme, I think, can make such a key difference for that child. Making sure that they clearly know that there's someone they can rely on. Making sure that the child is aware if a change is happening. You know, if a teacher's going to be gone for a while, that's, you know, announced in advance and understanding that it's not something they did or didn't do, things like that. I think small things like that actually can go a long way.

Moderator: Right. One more question. We have time for one more question. So, I'll combine a question from Barbie and Frances. And what they ask is, "Have you taken your training information to Congress?" And also, someone said, "I'm wondering what folks can do to advocate for stronger policies to support implementing this information in our programs." So, I think those are kind of related.

Dipesh: Yeah, they are. And I think that's actually a great one to end on. So, I'll say a couple of things. Have I taken it to Congress? Not me personally. There's a lot of other groups that are doing this kind of work, as well, that are trying to make sure we're being heard in the halls of Congress and in the state legislatures. Remember, so much happens at the state level, and it's not just necessarily, you know, all federal, federal, federal. And it's often easier to get in to see your representative at the state level, and so on. The other thing I'll say, though, is that I think that there's a big role for making sure that people are hearing from the early-childhood community as a whole. Mr. Dugger, who's the head of Ready Nation, actually got up at an AAP conference, and he said, "Look, let me just point something out here.

The Big Three automakers got up in front of Congress, right? They're bitter business rivals. They got up in front of Congress, sat right next to each other, and said, 'We're too big to fail. You need to bail us out.' Bitter business rivals. Early childhood, pediatrics, home visiting, early childhood education, et

cetera, et cetera -- all these folks -- We are a larger piece of America's economy than the Big Three automakers by far, yet we don't act like it, and we don't get up there together and say, 'Where's our bailout? Why aren't our kids getting the bailout, if you're going to bail out these guys in the auto industry?'" We have to learn how to talk together and come with one voice. And that, I think, is really one of the key things. Then they'll have to listen.

So.

Moderator: Very nice. Thank you very much for your talk. We appreciate it.

Dipesh: Thank you very much.

[Applause]